

Kohler-FAA Generator Set Startup and Onsite Orientation Procedures for Decision-Maker™ 550 Controller

Site/Installation Data	
Site	Contract No.
Address	City
State	Zip
Phone No.	Contact
Generator Set Information	
Generator Model	Engine Model
Generator Spec. No.	Engine Serial No.
Generator Serial No.	CLIN
Transfer Switch Information	
Model	Serial No.
Load Bank Information	
Model	Serial No.
Distributor Startup Representative	
Distributor	Representative Name
Date	Representative Signature
Subcontractor Startup Representative (if applicable)	
Company	Representative Name
Date	Representative Signature
FAA Project Engineer or Designated FAA Representative (must be an FAA employee)	
Authority Having Jurisdiction Name	Office/Organization
Authority Having Jurisdiction Signature	Date
Approved with the Following Exceptions (mark one box): <input type="checkbox"/> None <input type="checkbox"/> Listed on Page 2	

Exceptions

This table lists items that were not completed successfully. These exceptions must be resolved to complete the Startup Procedures.

[illegible]

Safety Precautions and Instructions

IMPORTANT SAFETY INSTRUCTIONS. Electromechanical equipment, including generator sets, transfer switches, switchgear, and accessories, can cause bodily harm and pose life-threatening danger when improperly installed, operated, or maintained. To prevent accidents be aware of potential dangers and act safely. Read and follow all safety precautions and instructions. **SAVE THESE INSTRUCTIONS.**

This manual has several types of safety precautions and instructions: Danger, Warning, Caution, and Notice.

DANGER

Danger indicates the presence of a hazard that **will cause severe personal injury, death, or substantial property damage.**

WARNING

Warning indicates the presence of a hazard that **can cause severe personal injury, death, or substantial property damage.**

CAUTION

Caution indicates the presence of a hazard that **will or can cause minor personal injury or property damage.**

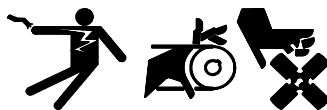
NOTICE

Notice communicates installation, operation, or maintenance information that is safety related but not hazard related.

Safety decals affixed to the equipment in prominent places alert the operator or service technician to potential hazards and explain how to act safely. The decals are shown throughout this publication to improve operator recognition. Replace missing or damaged decals.

Accidental Starting

WARNING



Accidental starting.
Can cause severe injury or death.

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or connected equipment, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

Battery

WARNING



Sulfuric acid in batteries.
Can cause severe injury or death.

Wear protective goggles and clothing. Battery acid may cause blindness and burn skin.

WARNING



Explosion.
Can cause severe injury or death.
Relays in the battery charger cause arcs or sparks.

Locate the battery in a well-ventilated area. Isolate the battery charger from explosive fumes.


Battery electrolyte is a diluted sulfuric acid. Battery acid can cause severe injury or death. Battery acid can cause blindness and burn skin. Always wear splashproof safety goggles, rubber gloves, and boots when servicing the battery. Do not open a sealed battery or mutilate the battery case. If battery acid splashes in the eyes or on the skin, immediately flush the affected area for 15 minutes with large quantities of clean water. Seek immediate medical aid in the case of eye contact. Never add acid to a battery after placing the battery in service, as this may result in hazardous spattering of battery acid.

Battery acid cleanup. Battery acid can cause severe injury or death. Battery acid is electrically conductive and corrosive. Add 500 g (1 lb.) of bicarbonate of soda (baking soda) to a container with 4 L (1 gal.) of water and mix the neutralizing solution. Pour the neutralizing solution on the spilled battery acid and continue to add the neutralizing solution to the spilled battery acid until all evidence of a chemical reaction (foaming) has ceased. Flush the resulting liquid with water and dry the area.

Battery gases. Explosion can cause severe injury or death. Battery gases can cause an explosion. Do not smoke or permit flames or sparks to occur near a battery at any time, particularly when it is charging. Do not dispose of a battery in a fire. To prevent burns and sparks that could cause an explosion, avoid touching the battery terminals with tools or other metal objects. Remove all jewelry before servicing the equipment. Discharge static electricity from your body before touching batteries by first touching a grounded metal surface away from the battery. To avoid sparks, do not disturb the battery charger connections while the battery is charging. Always turn the battery charger off before disconnecting the battery connections. Ventilate the compartments containing batteries to prevent accumulation of explosive gases.

Battery short circuits. Explosion can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage. Disconnect the battery before generator set installation or maintenance. Remove all jewelry before servicing the equipment. Use tools with insulated handles. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery. Never connect the negative (-) battery cable to the positive (+) connection terminal of the starter solenoid. Do not test the battery condition by shorting the terminals together.

Engine Backfire/Flash Fire

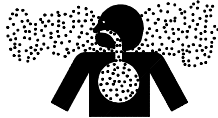
⚠ WARNING

Fire. Can cause severe injury or death. Do not smoke or permit flames or sparks near fuels or the fuel system.

Servicing the fuel system. A flash fire can cause severe injury or death. Do not smoke or permit flames or sparks near the fuel injection system, fuel line, fuel filter, fuel pump, or other potential sources of spilled fuels or fuel vapors. Catch fuels in an approved container when removing the fuel line or fuel system.

Servicing the air cleaner. A sudden backfire can cause severe injury or death. Do not operate the generator set with the air cleaner removed.

Combustible materials. A fire can cause severe injury or death. Generator set engine fuels and fuel vapors are flammable and explosive. Handle these materials carefully to minimize the risk of fire or explosion. Equip the compartment or nearby area with a fully charged fire extinguisher. Select a fire extinguisher rated ABC or BC for electrical fires or as recommended by the local fire code or an authorized agency. Train all personnel on fire extinguisher operation and fire prevention procedures.

Exhaust System

⚠ WARNING

Carbon monoxide. Can cause severe nausea, fainting, or death. The exhaust system must be leakproof and routinely inspected.

Generator set operation. Carbon monoxide can cause severe nausea, fainting, or death. Carbon monoxide is an odorless, colorless, tasteless, nonirritating gas that can cause death if inhaled for even a short time. Avoid breathing exhaust fumes when working on or near the generator set. Never operate the generator set inside a building unless the exhaust gas is piped safely outside. Never operate the generator set where exhaust gas could accumulate and seep back inside a potentially occupied building.


Carbon monoxide symptoms. Carbon monoxide can cause severe nausea, fainting, or death. Carbon monoxide is a poisonous gas present in exhaust gases. Carbon monoxide poisoning symptoms include but are not limited to the following:

- Light-headedness, dizziness
- Physical fatigue, weakness in joints and muscles
- Sleepiness, mental fatigue, inability to concentrate or speak clearly, blurred vision
- Stomachache, vomiting, nausea

If experiencing any of these symptoms and carbon monoxide poisoning is possible, seek fresh air immediately and remain active. Do not sit, lie down, or fall asleep. Alert others to the possibility of carbon monoxide poisoning. Seek medical attention if the condition of affected persons does not improve within minutes of breathing fresh air.

Copper tubing exhaust systems. Carbon monoxide can cause severe nausea, fainting, or death. Do not use copper tubing in diesel exhaust systems. Sulfur in diesel exhaust causes rapid deterioration of copper tubing exhaust systems, resulting in exhaust leakage.

Fuel System

⚠ WARNING

Explosive fuel vapors. Can cause severe injury or death.

Use extreme care when handling, storing, and using fuels.

The fuel system. Explosive fuel vapors can cause severe injury or death. Vaporized fuels are highly explosive. Use extreme care when handling and storing fuels. Store fuels in a well-ventilated area away from spark-producing equipment and out of the reach of children. Never add fuel to the tank while the engine is running because spilled fuel may ignite on contact with hot parts or from sparks. Do not smoke or permit flames or sparks to occur near sources of spilled fuel or fuel vapors. Keep the fuel lines and connections tight and in good

condition. Do not replace flexible fuel lines with rigid lines. Use flexible sections to avoid fuel line breakage caused by vibration. Do not operate the generator set in the presence of fuel leaks, fuel accumulation, or sparks. Repair fuel systems before resuming generator set operation.

Explosive fuel vapors can cause severe injury or death. Take additional precautions when using the following fuels:

Propane (LP)—Adequate ventilation is mandatory. Because propane is heavier than air, install propane gas detectors low in a room. Inspect the detectors per the manufacturer's instructions.

Natural Gas—Adequate ventilation is mandatory. Because natural gas rises, install natural gas detectors high in a room. Inspect the detectors per the manufacturer's instructions.

Fuel tanks. Explosive fuel vapors can cause severe injury or death. Gasoline and other volatile fuels stored in day tanks or subbase fuel tanks can cause an explosion. Store only diesel fuel in tanks.

Draining the fuel system. Explosive fuel vapors can cause severe injury or death. Spilled fuel can cause an explosion. Use a container to catch fuel when draining the fuel system. Wipe up spilled fuel after draining the system.

Gas fuel leaks. Explosive fuel vapors can cause severe injury or death. Fuel leakage can cause an explosion. Check the LP vapor gas or natural gas fuel system for leakage by using a soap and water solution with the fuel system test pressurized to 6–8 ounces per square inch (10–14 inches water column). Do not use a soap solution containing either ammonia or chlorine because both prevent bubble formation. A successful test depends on the ability of the solution to bubble.

LP liquid withdrawal fuel leaks. Explosive fuel vapors can cause severe injury or death. Fuel leakage can cause an explosion. Check the LP liquid withdrawal gas fuel system for leakage by using a soap and water solution with the fuel system test pressurized to at least 90 psi (621 kPa). Do not use a soap solution containing either ammonia or chlorine because both prevent bubble formation. A successful test depends on the ability of the solution to bubble.

Hazardous Noise

⚠ CAUTION



Hazardous noise.
Can cause hearing loss.

Never operate the generator set without a muffler or with a faulty exhaust system.

Engine noise. Hazardous noise can cause hearing loss. Generator sets not equipped with sound enclosures can produce noise levels greater than 105 dBA. Prolonged exposure to noise levels greater than 85 dBA can cause permanent hearing loss. Wear hearing protection when near an operating generator set.

Hazardous Voltage/ Electrical Shock

⚠ DANGER



Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

⚠ WARNING



Hazardous voltage. Moving rotor.
Can cause severe injury or death.

Operate the generator set only when all guards and electrical enclosures are in place.

⚠ WARNING



Hazardous voltage.
Backfeed to the utility system can cause property damage, severe injury, or death.

If the generator set is used for standby power, install an automatic transfer switch to prevent inadvertent interconnection of standby and normal sources of supply.

⚠ CAUTION



Welding the generator set.
Can cause severe electrical equipment damage.

Never weld components of the generator set without first disconnecting the battery, controller wiring harness, and engine electronic control module (ECM).

Grounding electrical equipment. Hazardous voltage can cause severe injury or death. Electrocutation is possible whenever electricity is present. Open the main circuit breakers of all power sources before servicing the equipment. Configure the installation to electrically ground the generator set, transfer switch, and related equipment and electrical circuits to comply with applicable codes and standards. Never contact electrical leads or appliances when standing in water or on wet ground because these conditions increase the risk of electrocution.

Disconnecting the electrical load. Hazardous voltage can cause severe injury or death. Disconnect the generator set from the load by opening the line circuit breaker or by disconnecting the generator set output leads from the transfer switch and heavily taping the ends of the leads. High voltage transferred to the load during testing may cause personal injury and equipment damage. Do not use the safeguard circuit breaker in place of the line circuit breaker. The safeguard circuit breaker does not disconnect the generator set from the load.

Welding on the generator set. Can cause severe electrical equipment damage. Before welding on the generator set perform the following steps: (1) Remove the battery cables, negative (-) lead first. (2) Disconnect all engine electronic control module (ECM) connectors. (3) Disconnect all generator set controller and voltage regulator circuit board connectors. (4) Disconnect the engine battery-charging alternator connections. (5) Attach the weld ground connection close to the weld location.

Installing the battery charger. Hazardous voltage can cause severe injury or death. An ungrounded battery charger may cause electrical shock. Connect the battery charger enclosure to the ground of a permanent wiring system. As an alternative, install an equipment grounding conductor with circuit conductors and connect it to the equipment grounding terminal or the lead on the battery charger. Install the battery charger as prescribed in the equipment manual. Install the battery charger in compliance with local codes and ordinances.

Connecting the battery and the battery charger. Hazardous voltage can cause severe injury or death. Reconnect the battery correctly, positive to positive and negative to negative, to avoid electrical shock and damage to the battery charger and battery(ies). Have a qualified electrician install the battery(ies).

Servicing the day tank. Hazardous voltage can cause severe injury or death. Service the day tank electrical control module (ECM) as prescribed in the equipment manual. Disconnect the power to the day tank before servicing. Press the day tank ECM OFF pushbutton to disconnect the power.

Notice that line voltage is still present within the ECM when the POWER ON light is lit. Ensure that the generator set and day tank are electrically grounded. Do not operate the day tank when standing in water or on wet ground because these conditions increase the risk of electrocution.

Short circuits. Hazardous voltage/current can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage. Do not contact electrical connections with tools or jewelry while making adjustments or repairs. Remove all jewelry before servicing the equipment.

Engine block heater. Hazardous voltage can cause severe injury or death. The engine block heater can cause electrical shock. Remove the engine block heater plug from the electrical outlet before working on the block heater electrical connections.

Handling the capacitor. Hazardous voltage can cause severe injury or death. Electrical shock results from touching the charged capacitor terminals. Discharge the capacitor by shorting the terminals together. *(Capacitor-excited models only)*

Electrical backfeed to the utility. Hazardous backfeed voltage can cause severe injury or death. Install a transfer switch in standby power installations to prevent the connection of standby and other sources of power. Electrical backfeed into a utility electrical system can cause severe injury or death to utility personnel working on power lines.

Installing accessories to the transfer switch transformer assembly. Hazardous voltage can cause severe injury or death. To prevent electrical shock, deenergize all power sources and then disconnect the harness plug before installing accessories that will be connected to the transformer assembly primary terminals on microprocessor logic models. Terminals are at line voltage.


Making line or auxiliary connections. Hazardous voltage can cause severe injury or death. To prevent electrical shock deenergize the normal power source before making any line or auxiliary connections.


Servicing the transfer switch. Hazardous voltage can cause severe injury or death. Deenergize all power sources before servicing. Open the main circuit breakers of all transfer switch power sources and disable all generator sets as follows: (1) Move all generator set master controller switches to the OFF position. (2) Disconnect power to all battery chargers. (3) Disconnect all battery cables, negative (-) leads first. Reconnect negative (-) leads last when reconnecting the battery cables after servicing. Follow these precautions to prevent the starting of generator sets by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer. Before servicing any components inside the enclosure: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Test circuits with a voltmeter to verify that they are deenergized.

Servicing the transfer switch controls and accessories within the enclosure. Hazardous voltage can cause severe injury or death. Disconnect the transfer switch controls at the inline connector to deenergize the circuit boards and logic circuitry but allow the transfer switch to continue to supply power to the load. Disconnect all power sources to accessories that are mounted within the enclosure but are not wired through the controls and deenergized by inline connector separation. Test circuits with a voltmeter to verify that they are deenergized before servicing.


Testing live electrical circuits. Hazardous voltage or current can cause severe injury or death. Have trained and qualified personnel take diagnostic measurements of live circuits. Use adequately rated test equipment with electrically insulated probes and follow the instructions of the test equipment manufacturer when performing voltage tests. Observe the following precautions when performing voltage tests: (1) Remove all jewelry. (2) Stand on a dry, approved electrically insulated mat. (3) Do not touch the enclosure or components inside the enclosure. (4) Be prepared for the system to operate automatically. *(600 volts and under)*


Heavy Equipment

⚠ WARNING

<p>Unbalanced weight. Improper lifting can cause severe injury or death and equipment damage.</p> <p>Do not use lifting eyes. Lift the generator set using lifting bars inserted through the lifting holes on the skid.</p>

⚠ WARNING

<p>Unbalanced weight. Improper lifting can cause severe injury or death and equipment damage.</p> <p>Use adequate lifting capacity. Never leave the transfer switch standing upright unless it is securely bolted in place or stabilized.</p>

Hot Parts

⚠ WARNING

<p>Hot coolant and steam. Can cause severe injury or death.</p> <p>Before removing the pressure cap, stop the generator set and allow it to cool. Then loosen the pressure cap to relieve pressure.</p>

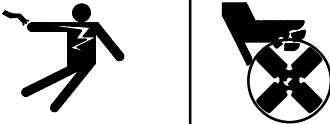
⚠ WARNING

<p>Hot engine and exhaust system. Can cause severe injury or death.</p> <p>Do not work on the generator set until it cools.</p>

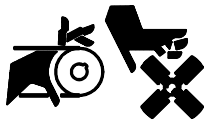
Servicing the alternator. Hot parts can cause severe injury or death. Avoid touching the alternator field or exciter armature. When shorted, the alternator field and exciter armature become hot enough to cause severe burns.

Checking the coolant level. Hot coolant can cause severe injury or death. Allow the engine to cool. Release pressure from the cooling system before removing the pressure cap. To release pressure, cover the pressure cap with a thick cloth and then slowly turn the cap counterclockwise to the first stop. Remove the cap after pressure has been completely released and the engine has cooled. Check the coolant level at the tank if the generator set has a coolant recovery tank.

Servicing the exhaust system. Hot parts can cause severe injury or death. Do not touch hot engine parts. The engine and exhaust system components become extremely hot during operation.

Moving Parts

⚠ WARNING

<p>Hazardous voltage. Moving rotor. Can cause severe injury or death.</p> <p>Operate the generator set only when all guards and electrical enclosures are in place.</p>

⚠ WARNING

<p>Rotating parts. Can cause severe injury or death.</p> <p>Operate the generator set only when all guards, screens, and covers are in place.</p>

Tightening the hardware. Flying projectiles can cause severe injury or death. Loose hardware can cause the hardware or pulley to release from the generator set engine and can cause personal injury. Retorque all crankshaft and rotor hardware after servicing. Do not loosen the crankshaft hardware or rotor throbolt when making adjustments or servicing the generator set. Rotate the crankshaft manually in a clockwise direction only. Turning the crankshaft bolt or rotor throbolt counterclockwise can loosen the hardware.

Servicing the generator set when it is operating. Exposed moving parts can cause severe injury or death. Keep hands, feet, hair, clothing, and test leads away from the belts and pulleys when the generator set is running. Replace guards, screens, and covers before operating the generator set.

Notice

NOTICE

Voltage reconnection. Affix a notice to the generator set after reconnecting the set to a voltage different from the voltage on the nameplate. Order voltage reconnection decal 246242 from an authorized service distributor/dealer.

NOTICE

Hardware damage. The engine and generator set may use both American Standard and metric hardware. Use the correct size tools to prevent rounding of the bolt heads and nuts.

NOTICE

Hardware damage. The transfer switch may use both American Standard and metric hardware. Use the correct size tools to prevent rounding of the bolt heads and nuts.

NOTICE

When replacing hardware, do not substitute with inferior grade hardware. Screws and nuts are available in different hardness ratings. To indicate hardness, American Standard hardware uses a series of markings, and metric hardware uses a numeric system. Check the markings on the bolt heads and nuts for identification.

NOTICE

Improper operator handle usage. Use the manual operator handle on the transfer switch for maintenance purposes only. Return the transfer switch to the normal position. Remove the manual operator handle, if used, and store it in the place provided on the transfer switch when service is completed.

NOTICE

Foreign material contamination. Cover the transfer switch during installation to keep dirt, grit, metal drill chips, and other debris out of the components. Cover the solenoid mechanism during installation. After installation, use the manual operating handle to cycle the contactor to verify that it operates freely. Do not use a screwdriver to force the contactor mechanism.

1.1 Overview

This startup procedure was jointly developed by Kohler Power Systems and the FAA Program office for Generator Replacement Contracts D-95049 and D-06602. It is intended to satisfy the *Engineering Support Services* requirements of the contract pertaining to *onsite*:

- Startup warranty validation
- Orientation training
- Equipment maintenance training

The equipment provided is in accordance with the bill of material (BOM) developed to meet the contract specifications.

This COTS equipment BOM may not meet nor is it intended to meet all the requirements of the previous FAA specifications and/or maintenance orders, i.e., Order 6980.11.

These tests are designed to be run and recorded using common diagnostic tools and meters. We do not require the use of recording meters or strip charts to capture performance parameters.

The following equipment is required for a standard FAA warranty startup:

- Common hand tools
- Multimeter
- Two AC analog voltmeters (closed transition automatic transfer switches only)
- Decision-Maker™ 550 Operation Manual, TP-6200
- Engine Operation Manual
- Warranty Startup Procedure Requirements Service Bulletin SB-616

1.2 Installation Contractor's Prestart Checklist

Complete the following checks before the startup date. See the engine operation/maintenance manuals for specifications and quantities of lubricants, coolants, etc.

These procedures are suitable for use with any Kohler generator set system with a Decision-Maker™ 550 controller purchased by the FAA on the national contract.

Note: Due to difference in site equipment, some tests may not be applicable to all sites. Clearly indicate when a test cannot be completed because of equipment configuration.

If a remote audiovisual alarm is installed, check the indications at the remote station at the same time as checking the indications on the EC controller. Record any discrepancies for later correction.

1.2.1 Oil Level

Check that the oil level is at or near the FULL mark on dipstick but not over. Check the oil level in the governor, if applicable; oil should be at or near full level. Check the operation/maintenance manuals for specific lubrication specifications.

1.2.2 Fuel Level

Make sure there is an adequate fuel supply; keep tanks full to allow operation for extended periods.

1.2.3 Battery

Check the connections, check the electrolyte level, and charge the battery. See TT-796, Battery Activation Installation Instructions (Dry-Charged Batteries).

1.2.4 Air Cleaner

Check that the air cleaner is clean and properly installed to prevent unfiltered air from entering the engine.

1.2.5 Operating Area

Make sure there are no obstructions that could block the flow of cooling air. Make sure area is clean. Do not leave rags, tools, or debris on or near the generator set.

1.2.6 Coolant Level

Maintain coolant level at approximately 19–38 mm (3/4–1 1/2 in.) below the radiator fill neck seat when the engine is cold. If the generator set is equipped with a coolant recovery tank, coolant level in the tank should be between 1/3 full (cold) and 2/3 full (hot).

See the safety precautions before filling the radiator. Typically, use a coolant solution of 50% ethylene glycol and 50% clean, softened water to inhibit rust/corrosion. Follow the engine manufacturer's recommendations for coolant type if different than stated previously.

A coolant solution of 50% ethylene glycol provides freezing protection to -37°C (-34°F) and overheating protection to 129°C (265°F). A coolant solution with more than 50% ethylene glycol can cause damage to the engine and components. Do not use alcohol or methanol antifreeze or mix them with the specified coolant. Consult the engine manufacturer's operation manual for specific engine coolant specifications.

Do not add coolant to an overheated engine; wait until the engine has cooled. Adding coolant to an extremely hot engine can cause a cracked block or cylinder head.

Note: Do not turn on the block heater before filling cooling system. Before energizing a block heater, run the engine until warm and refill the radiator to purge air from the system. Block heater failure will result if the heater element is not immersed in water.

1.2.7 Exhaust System

The exhaust outlet must be clear; the silencer and piping must be tight and in good condition.

1.2.8 Electrical Interconnections

Connect all power and control electrical connections for the battery charger, block heater, ATS, day tank, fuel converter, etc., per installation drawings.

Note: Balance the site load as close as possible on all phases.

1.3 Typical Schedule of Events

- Review sequence of events with all parties
- Installation inspection including connections, clearances, fluid levels, etc.
- Emergency stop test
- Operation and performance tests
- ATS startup verification
- One hour/load bank test
- Governor test
- Load bank operation test
- Cold start test; see Section 1.8, Optional Onsite Tests
- Two-hour site load test
- Load bank shed/share verification

- ATS facility load transfer/bypass verification
- Day tank verification
- Remote monitoring system
- Onsite orientation/maintenance training

1.4 Installation Inspection

- Engine generator
- Automatic transfer switch (ATS); see Section 1.14.1., Visual and Mechanical Inspection
- Load bank
- Day tank or gas vaporizer

1.5 Emergency Stop/No Load Test

1.5.1 Local Emergency Stop Test

The following safety test verifies the generator set emergency stop function. Disconnect the generator set from load by opening the line circuit breaker.

1. Move the generator set master switch (RUN-OFF/RESET-AUTO) to the RUN position to start the generator set.
2. Allow the generator set to come up to rated voltage and frequency.
3. Push the generator set controller emergency stop switch to test the local emergency stop function. Generator sets with the Decision-Maker™ 550 controllers include an emergency stop switch. Does the generator set shut down immediately?

Yes No

4. Does EMERGENCY STOP appear on the controller display and does the generator set *System Shutdown* lamp illuminate?

Yes No

5. Reset the generator set controller by moving the generator set master switch to the OFF/RESET position.

Note: Recheck oil level. Oil level should be at or near the FULL mark on the dipstick.

Record Test Results: Pass Fail

1.5.2 Remote Emergency Stop Test

1. Move the generator set master switch to the RUN position to start the generator set.
2. Allow the generator set to come up to rated voltage and frequency.
3. Verify the remote emergency stop function by using **one** of the following methods.
 - a. Remove the glass piece and activate the remote emergency stop switch and go to step 6.
 - b. Open the circuit of the remote emergency stop switch at the remote location and go to step 6.
 - c. Use the following procedure to simulate a remote emergency stop. Go to step 4.
4. Remove the controller cover.
5. Disconnect wire 1 or 1A on terminal strip TB1 to check the remote emergency stop circuit.
6. Does the generator set immediately shut down?

Yes No
7. Does EMERGENCY STOP appear on the controller display and does the generator set *System Shutdown* lamp illuminate?

Yes No
8. **If method c was selected**, reconnect wires 1 and 1A to terminal strip TB1 in the controller.
9. Reset the generator set controller by moving the generator set master switch to the OFF/RESET position.

Record Test Results: Pass Fail

1.6 Generator Set Operational and Performance Checks

The following checks test the generator set starting and stopping from the generator set controller.

1. Lamp Test
 - a. Move the generator set master switch to the OFF/RESET position.
 - b. Press the RESET MENU key.

- c. Press the LAMP-TEST key. Do the alarm lamps on the controller front panel illuminate and does the digital display light? Record results below.

System Ready	Yes	No
Not In Auto	Yes	No
Programming Mode	Yes	No
System Warning	Yes	No
System Shutdown	Yes	No
Digital Display	Yes	No

2. Generator Set Start

With no load applied, move the generator set master switch to the RUN position. Does the generator set start and come up to rated voltage and frequency?

Yes No

3. Oil or Coolant Leaks

Allow the generator set to run for approximately 5 minutes. Is there any indication of lube oil, fuel oil, or coolant leaks from the generator set?

Yes No

4. Steady-State Operation

Does the generator set run smoothly during steady state operation?

Yes No

5. Stopping

Return the generator set master switch to the OFF/RESET position. Does the generator set promptly stop?

Yes No

6. Not in Auto Fault

Does the *Not in Auto* lamp illuminate and does NOT IN AUTO appear on the controller display?

Yes No

Record Test Results: Pass Fail

1.7 System Fault Annunciation Tests

Note: For the tests outlined in Sections 1.7.1 through 1.7.14, move the generator set master switch to the RUN position for starting. Move the generator set master switch to the OFF/RESET position to reset after each fault test. Refer to the wiring diagrams in the supplied manuals to locate the circuit wires.

Some engine fault switches do not function during the first 30 seconds after startup (inhibit time). These fault switches include:

- High coolant temperature warning and shutdown
- High oil temperature shutdown, if equipped
- Low coolant level shutdown
- Low oil pressure warning and shutdown

1.7.1 Overspeed Protection Test

Does this model generator set have a computer-controlled engine control module (ECM) engine with engine controller logic that prevents manual control of the engine speed?

Yes No

If YES, this test cannot be performed. Go to the next test.

If NO, proceed with this test.

Note: Complete the test within the first 10 seconds after engine startup or the generator set may shut down on overfrequency (normally set at 63 Hz).

To test the overspeed fault protection:

1. Move the generator set master switch to the RUN position to start the generator set.
2. Select FREQUENCY on the digital display in Menu 7, Generator System.
3. Using the generator set controller, not the throttle actuator or the injector control rod, manually increase the engine speed until the generator set shuts down.

Does OVERSPEED appear on the controller display and does the generator set *System Shutdown* lamp illuminate when the frequency reaches 70 Hz (2100 rpm)?

Yes No

Note: If engine speed adjustment does not advance to 70 Hz, reset overspeed setting to 65 Hz and repeat test to check circuit operation. Follow the instructions in the respective generator set service manual. Reset system overspeed to 70 Hz when this test is complete.

4. Move the generator set master switch to the OFF/RESET position.

Record Test Results: Pass Fail

5. Adjust the engine speed back to 1803 rpm \pm 2 rpm (60.1 Hz \pm 0.05 Hz).

1.7.2 Overfrequency Test

Does this model generator set have a computer-controlled engine control module (ECM) engine with engine controller logic that prevents manual control of the engine speed?

Yes No

If YES, this test cannot be performed. Go to the next test.

If NO, proceed with this test.

To test the overfrequency fault protection:

1. Move the generator set master switch to the RUN position to start the generator set.
2. Select FREQUENCY on the digital display in Menu 7, Generator System.
3. Using the generator set controller, not the throttle actuator or the injector control rod, manually increase the engine speed until the generator set shuts down after a 10 second time delay. Record the frequency when the generator set shuts down.
_____ Hz

Note: If OVERFREQUENCY shutdown does not occur at 63 Hz, reset the OVERFREQUENCY fault to 63 Hz (105%).

4. Does OVERFREQUENCY appear on the controller display and does the generator set *System Shutdown* lamp illuminate when the frequency reaches 63 Hz (1890 rpm)?

Yes No

Record Test Results: Pass Fail

5. Adjust the engine speed back to 1803 rpm \pm 2 rpm (60.1 Hz \pm 0.05 Hz).

1.7.3 Underfrequency Test

Does this model generator set have a computer-controlled engine control module (ECM) engine with engine controller logic that prevents manual control of the engine speed?

Yes No

If YES, this test cannot be performed. Go to the next test.

If NO, proceed with this test.

To test the underfrequency fault protection:

1. Move the generator set master switch to the RUN position to start the generator set.
2. Select FREQUENCY on the digital display in Menu 7, Generator System.
3. Using the generator set controller, not the throttle actuator or the injector control rod, manually decrease the engine speed until the generator set shuts down after a 10 second time delay. Record the frequency when the generator set shuts down.
_____ Hz

Note: If UNDERFREQUENCY shutdown does not occur at 57 Hz, reset the UNDERFREQUENCY fault to 57 Hz (95%).

4. Does UNDERFREQUENCY appear on the controller display and does the generator set *System Shutdown* lamp illuminate when the frequency reaches 63 Hz (1890 rpm)?

Yes No

Record Test Results: Pass Fail

5. Adjust the engine speed back to 1803 rpm ± 2 rpm (60.1 Hz ± 0.05 Hz).

1.7.4 Overvoltage Test

To test the overvoltage fault protection:

1. Move the generator set master switch to the RUN position to start the generator set.

- a. **CLINS 421-452, FAA Rating 10-250 kW.**
Select L1-L2 VOLTS on the digital display in Menu 1, Generator Monitoring. Manually increase the voltage using the adjust potentiometer on the controller front panel until the generator set shuts down after a 2-10 second time delay.

Record the voltage level when the generator set shuts down. _____ volts

- b. **CLINS 453-466, FAA Rating 300-900 kW.**
Go to Menu 14, Programming Mode, and select local programming if not already done. Go to Menu 1, Generator Monitoring, and select the L1-L2 VOLTS/INCREASE VOLTAGE on the digital display. Use the YES key to increase the voltage until the generator set shuts down after a 2-10 second time delay.

Record the voltage level when the generator set shuts down. _____ volts

2. Does OVERVOLTAGE appear on the controller display and does the generator set *System Shutdown* lamp illuminate?

Yes No

Record Test Results: Pass Fail

3. Adjust the generator set voltage to the correct nominal voltage for the generator set.

Note: There is no dedicated undervoltage shutdown or annunciation. The generator set is inherently protected.

1.7.5 Information, Fault Tests in Sections 1.7.6 through 1.7.12

The fault tests outlined in Sections 1.7.6 through 1.7.12 can be performed by connecting a jumper wire from the appropriate controller terminal to the engine block ground. Remove the controller cover if this test system is used.

1.7.6 Low Oil Pressure Warning Test

Does this model generator set have a computer-controlled engine control module (ECM) engine with engine controller logic that prevents testing the low oil pressure warning?

Yes No

If YES, this test cannot be performed. Go to the next test.

If NO, proceed with this test.

To test the low oil pressure warning fault protection:

1. Move the generator set master switch to the RUN position to start the generator set.
2. Remove sensor lead 41A and ground the lead to the engine block or connect a jumper wire from the sensor terminal to the engine block.
3. Does LOW OIL PRESSURE WARNING appear on the controller display and does the generator set *System Warning* lamp illuminate?

Yes No

Does the generator set continue to run?

Yes No

Record Test Results: Pass Fail

4. Remove jumper wire and reconnect the sensor lead.

1.7.7 Low Oil Pressure Shutdown Test

Does this model generator set have a computer-controlled engine control module (ECM) engine with engine controller logic that prevents testing the low oil pressure shutdown?

Yes No

If YES, this test cannot be performed. Go to the next test.

If NO, proceed with this test.

To test the low oil pressure shutdown fault protection:

1. Move the generator set master switch to the RUN position to start the generator set, if not already running.
2. Remove sensor lead 13 and ground the lead to the engine block or connect a jumper wire from the sensor terminal to the engine block. The generator set should shut down after a 5 second time delay.
3. Does OIL PRESSURE SHUTDOWN appear on the controller display and does the generator set *System Shutdown* lamp illuminate?

Yes No

Does the generator set stop?

Yes No

Record Test Results: Pass Fail

4. Remove jumper wire and reconnect the sensor lead.

1.7.8 High Coolant Temperature Warning Test

Does this model generator set have a computer-controlled engine control module (ECM) engine with engine controller logic that prevents testing the high coolant temperature warning?

Yes No

If YES, this test cannot be performed. Go to the next test.

If NO, proceed with this test.

To test the high coolant temperature warning fault protection:

1. Move the generator set master switch to the RUN position to start the generator set.
2. Remove sensor lead 40A and ground the lead to the engine block or connect a jumper wire from the sensor terminal to the engine block.
3. Does HI COOL TEMP WARNING appear on the controller display and does the generator set *System Warning* lamp illuminate?

Yes No

Does the generator set continue to run?

Yes No

Record Test Results: Pass Fail

4. Remove jumper wire and reconnect the sensor lead.

1.7.9 High Coolant Temperature Shutdown Test

Does this model generator set have a computer-controlled engine control module (ECM) engine with engine controller logic that prevents testing high coolant temperature shutdown?

Yes No

If YES, this test cannot be performed. Go to the next test.

If NO, proceed with this test.

To test the high coolant temperature shutdown fault protection:

1. Move the generator set master switch to the RUN position to start the generator set, if not already running.
2. Remove sensor lead 34 and ground the lead to the engine block or connect a jumper wire from the sensor terminal to the engine block. The generator set should shut down after a 5 second time delay.
3. Does HI COOL TEMP SHUTDOWN appear on the controller display and does the generator set *System Shutdown* lamp illuminate?

Yes No

Does the generator set stop?

Yes No

Record Test Results: Pass Fail

4. Remove jumper wire and reconnect the sensor lead.

1.7.10 Low Coolant Temperature Warning Test

Does this model generator set have a computer-controlled engine control module (ECM) engine with engine controller logic that prevents testing the low coolant temperature warning?

Yes No

If YES, this test cannot be performed. Go to the next test.

If NO, proceed with this test.

To test the low coolant temperature warning fault protection:

Note: If the site temperature is 16°C (60°F) or below, the sender can also be checked by allowing the generator set room to cool overnight with the block heater unplugged and the generator set room heating disabled.

1. Move the generator set master switch to the AUTO position. The generator set should not start.
2. Remove sensor lead 35A and ground the lead to the engine block or connect a jumper wire from the sensor terminal to the engine block.
3. Does LOW COOLANT TEMP appear on the controller display and does the generator set *System Warning* lamp illuminate?

Yes No

Does the generator set continue to run?

Yes No

Record Test Results: Pass Fail

4. Remove jumper wire and reconnect the sensor lead.

1.7.11 Low Coolant Level Shutdown Test

Does this model generator set have a computer-controlled engine control module (ECM) engine with engine controller logic that prevents testing the low coolant level shutdown?

Yes No

If YES, this test cannot be performed. Go to the next test.

If NO, proceed with this test.

To test the low coolant level shutdown fault protection:

1. Move the generator set master switch to the RUN position to start the generator set, if not already running.
2. Remove sensor lead 31A and ground the lead to the engine block or connect a jumper wire from the sensor terminal to the engine block. The generator set should shut down after a 5 second time delay.
3. Does LOW COOLANT LEVEL appear on the controller display and does the generator set *System Shutdown* lamp illuminate?

Yes No

Does the generator set stop?

Yes No

Record Test Results: Pass Fail

4. Remove jumper wire and reconnect the sensor lead.

1.7.12 Low Fuel Warning Test

Note: These procedures can be used to test the Low Fuel Warning on a generator set with a natural gas, LP gas, or diesel fueled engine.

To test the low fuel warning fault protection:

Note: This fault test can be performed by connecting a jumper wire from controller terminal TB4-2 to the engine block ground. This type of test is convenient especially for testing the low fuel warning where the actual sensor may be at a remote location. However, this type of test is less reliable since the wiring to the sensor is not part of the test circuit. Remove the controller cover if this test system is used.

Note: For a diesel fueled engine, the sender viability can be checked by deenergizing the day tank pump and drawing down the fuel level during test runs.

Note: For a natural gas or LP gas fueled engine, the sender viability can be checked by slowly closing the fuel valve on the gas supply line.

1. For a natural gas or LP gas fueled engine, remove sensor lead 63 and ground the lead to the engine block ground system or connect a jumper wire from the sensor terminal to the engine block ground system.

For a diesel fueled engine, connect a jumper wire across the low fuel contact terminals on the day tank.

2. Does LOW FUEL appear on the controller display and does the generator set *System Warning* lamp illuminate?

Yes No

Does the generator set continue to run?

Yes No

Record Test Results: Pass Fail

3. Remove jumper wire and reconnect the sensor lead.
4. Restore the fuel system to automatic operation.
 - a. **For natural gas or LP gas systems**, open the fuel valve on the gas supply line.
 - b. **For diesel systems**, reenergize the day tank and observe that the pump fills the day tank to 100%.

1.7.13 Battery Charger Fault Warning Test

To test the battery charger fault warning protection:

Note: Do not leave the battery charger deenergized for any length of time or LOW BATTERY VOLTAGE may appear on the controller display during the overcrank test.

1. Deenergize the battery charger power supply.
2. Does BATTERY CHARGER FAULT appear on the controller display and does the generator set *System Warning* lamp illuminate?

Yes No

Does the generator set continue to run?

Yes No

Record Test Results: Pass Fail

3. If the Low Battery Voltage Warning Test is required, leave the battery charger power supply deenergized until the Overcrank Shutdown Test and Low Battery Voltage Warning Test are complete.

If the Low Battery Voltage Warning Test is not required, reenergize the battery charger power supply.

1.7.14 Overcrank Shutdown Test and Low Battery Voltage Warning Test

Note: To observe the Low Battery Voltage Warning Test, deenergize the battery charger power supply if not already done and conduct the Overcrank Shutdown Test. It may be necessary to conduct the Overcrank Shutdown Test several times to sufficiently discharge the generator set batteries where the monitoring circuits can detect a low battery voltage condition. There is no external sensor circuit for the Low Battery Voltage Warning Test.

Overcrank Shutdown Test

1. Disable the fuel system to prevent engine starting.
2. Move the generator set master switch to the RUN position. The default engine cranking cycle is shown below.

Cyclic Cranking with:

15 Seconds Crank
15 Seconds Rest
15 Seconds Crank
15 Seconds Rest
15 Seconds Crank

3. When the engine fails to start after the third 15-second cranking attempt, does OVERCRANK appear on the controller display and does the generator set *System Shutdown* light illuminate?

Yes No

Does the generator set suspend further engine cranking attempts?

Yes No

Record Test Results: Pass Fail

Note: LOW BATTERY VOLTAGE may display on the controller *during* the overcrank test.

4. Reset the generator set controller by moving the generator set master switch to the OFF/RESET position.
5. If the Low Battery Voltage Warning Test is required, go to step 6.

If the Low Battery Voltage Warning Test is not required, go to the next test.

6. If LOW BATTERY VOLTAGE display does appear on the controller, go to step 7.

If LOW BATTERY VOLTAGE display does not appear on the controller, repeat steps 2 through 4 to sufficiently discharge the generator set batteries.

Low Battery Voltage Warning Test

7. Does LOW BATTERY VOLTAGE appear on the controller display and does the generator set *System Warning* lamp illuminate?

Yes No

Does the generator set continue to run.

Yes No

Record Test Results: Pass Fail

8. Go to Section 1.7.15, Battery Charger Test.

1.7.15 Battery Charger Test

Section 1.7.14, Overcrank Shutdown Test and Low Battery Voltage Warning Test, verify the battery charger alarm system.

1. After performing the **Overcrank Shutdown Test and Low Battery Voltage Warning Test**, reenergize the battery charger power supply.

2. Does the battery charger indicate an increased charge rate after performing the overcrank shutdown test and then reenergizing the power supply?

Yes No

3. Move the generator set master switch to the OFF/RESET position, then to the AUTO position. Does the LOW BATTERY VOLTAGE message disappear on the controller display and does the generator set *System Warning* lamp go out?

Yes No

Does the OVERCRANK message disappear on the controller display and does the generator set *System Shutdown* lamp go out?

Yes No

Record Test Results: Pass Fail

1.7.16 Generator Set Master Switch Not in Auto Position Test

To test the generator set master switch not in auto position fault protection:

1. Move the generator set master switch to the OFF/RESET position.
2. Does NOT IN AUTO appear on the controller display, does the generator set *Not in Auto* lamp illuminate, and does the audible alarm sound?

Yes No

3. Move the generator set master switch to the RUN position.

4. Does NOT IN AUTO appear on the controller display, does the generator set *Not in Auto* lamp illuminate, and does the audible alarm sound?

Yes No

Record Test Results: Pass Fail

5. Move the generator set master switch to the AUTO position.

6. Does NOT IN AUTO disappear on the controller display, does the generator set *Not in Auto* lamp go out, and does the audible alarm stop?

Yes No

Record Test Results: Pass Fail

1.8 Optional Onsite Tests

The following checks are not required as part of the Kohler warranty startup procedure but may be accomplished later by the local maintenance organization. These checks are not necessary and are impractical to do at many sites.

Verification of sender operations for:

- Low oil pressure shutdown
- Pre-low oil pressure warning
- High coolant temperature shutdown
- Pre-high coolant temperature warning
- Low coolant level shutdown
- Cold start, overnight cooldown with block heater functioning
- Low water temperature warning

Note: Kohler verifies control circuit operation onsite and has a factory quality control (QC) system for sender operation validation.

1.9 One Hour Load Bank Test

1. Turn the generator set load sensing potentiometer to maximum.

Note: The relay will be reset at the completion of this test.

2. Start the generator set and allow it to come up to rated voltage and frequency.
3. Using the load bank, add load up to simulated facility load level.

Note: Not all readings will be available on single-phase sets.

4. Check and record the information in Figure 1 at the listed intervals after startup.
5. Increase load bank load up to FAA prime nameplate rating. Continue the balance of the one-hour test at prime rated load. See Figure 2.

Interval, min.	Volts	Amps	Frequency, Hz	Oil Pressure, kPa (psi)	Water Temperature, °C (°F)	Battery Charging Rate, Volts/Amps	Day Tank Level
5		L3-L1	L3				
		L1-L2	L1				
		L2-L3	L2				
10		L3-L1	L3				
		L1-L2	L1				
		L2-L3	L2				
15		L3-L1	L3				
		L1-L2	L1				
		L2-L3	L2				
30		L3-L1	L3				
		L1-L2	L1				
		L2-L3	L2				

Figure 1 Load Bank 5-30 Minute Testing Results

Interval, min.	Volts	Amps	Frequency, Hz	Oil Pressure, kPa (psi)	Water Temperature, °C (°F)	Battery Charging Rate, Volts/Amps	Day Tank Level
30		L3-L1	L3				
		L1-L2	L1				
		L2-L3	L2				
45		L3-L1	L3				
		L1-L2	L1				
		L2-L3	L2				
60		L3-L1	L3				
		L1-L2	L1				
		L2-L3	L2				

Figure 2 Load Bank 30-60 Minute Testing Results at Prime Rating

1.10 Relay to Shunt-Trip Load Bank Circuit Breaker Check

This check confirms the relay function controlling the load bank circuit breaker:

- (1) to a 5-second time delay after sensing and before activation and
- (2) to activate when sensing just above 100% load bank load.

Note: Only qualified personnel should attempt these procedures.

Note: Refer to the 550 Controller Operation Manual, TP-6200, as needed.

1.10.1 Site Setup

1. If the site is operational and the generator set is commissioned, advise Air Traffic that the generator set backup power is available during testing.

Is the generator set main circuit breaker feeding the facility load in the CLOSED position?

Yes No

2. If the site is not operational or the generator set is not commissioned, this procedure will not affect the operation of the site.

Is the generator set main circuit breaker feeding the facility load in the OPEN position?

Yes No

3. On the load bank controller, move the load bank control power switch to the OFF position. Move the master load switch to the OFF position. Move the load step switches to the OFF position.

4. Is the load bank circuit breaker in the CLOSED position?

Yes No

Note: On smaller generator sets, the load bank circuit breaker is mounted in the generator set junction box. On larger generator sets, the load bank circuit breaker is mounted in a separate NEMA 1 enclosure.

Record Test Results: Pass Fail

1.10.2 550 Controller Settings Check

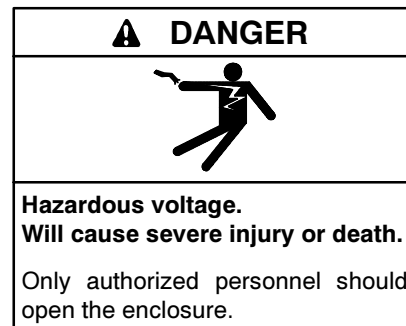
1. Establish local programming. Go to **Appendix A** and complete the controller keypad entries.
2. Enable RDO-30 as load shed kW overload. Go to **Appendix B** and complete the keypad entries.
3. Check the percent of load and time delay. Go to **Appendix C** and complete the keypad entries.

1.10.3 Start, Generator Set and Load Bank

1. On the generator set controller, move the generator set master switch to the RUN position.

Does the generator set start and run?

Yes No



Short circuits. Hazardous voltage/current can cause severe injury or death. Short circuits can cause bodily injury and/or equipment damage. Do not contact electrical connections with tools or jewelry while making adjustments or repairs. Remove all jewelry before servicing the equipment.

2. Observe the generator set output on the controller display.

Does the controller display show normal frequency?

Yes No

Does the controller display show normal voltage?

Yes No

Does the controller display shown zero amps?

Yes No

3. On the load bank controller, move load bank control power switch to the MANUAL position.

4. On the load bank controller, move master load switch to the ON position.

Record Test Results: Pass Fail

1.10.4 Time Delay on Shunt Trip Check

The time delay will be tested and adjusted until the load bank circuit breaker trips 5 seconds after the load is applied.

1. On the load bank controller, move the first load step switch to the ON position. Observe and record the load on the generator set controller _____ kW and load bank controller _____ kW.
2. On the load bank controller, slowly add load by moving load step switches to the ON positions until load bank circuit breaker trips. The trip point should be in excess of 80% load.
3. On the load bank controller, move master load switch to the OFF position. Leave load step switches in the ON positions.
4. RESET and then CLOSE the load bank circuit breaker.
5. Prepare to measure the time delay setting by observing a watch that measures *seconds*. Measure the time between (1) moving the master load bank switch to the ON position and (2) when the load bank circuit breaker trips.
_____seconds
6. On the load bank controller, move the master load switch to the ON position. Measure the time until the load bank circuit breaker trips.
_____seconds

1.10.5 Restore Site to Normal Conditions

1. On the load bank controller, slowly remove load by moving load step switches to the OFF position until load bank load is zero.
2. On the load bank controller, move master load switch to the OFF position.
3. Allow the generator set to run for 5 minutes to cool down.
4. After 5-minute cooldown, move the generator set master switch to the OFF/RESET position.

5. Reset the percent of load. Go to **Appendix D** and complete the keypad entries.

6. Reset the programming mode to local. Go to **Appendix E** and complete the keypad entries.

7. If the site is not operational or the generator set is not commissioned, go to step 14.

If the site is operational and commissioned, move the generator set master switch to the AUTO position. Go to step 8.

8. On the load bank controller, move the control power switch to the AUTO position.

9. Is the generator set circuit breaker CLOSED?

Yes No

10. Is the load bank circuit breaker CLOSED?

Yes No

11. On the load bank controller, move the master switch to the AUTO position.

12. Advise Air Traffic that testing is complete and the site is restored to full automatic condition.

13. Go to step 18.

14. On the load bank controller, move the control power switch to the OFF position.

15. Is the generator set circuit breaker OPEN?

Yes No

16. Is the load bank circuit breaker OPEN?

Yes No

17. Turn off power to all unnecessary equipment.

18. End of procedure 1.10, go to procedure 1.11.

Record Test Results: Pass Fail

1.11 Governor Test, Generator Set Voltage/Frequency Regulation and Stability

Check the generator set for frequency and voltage stability at variable increments.

Load the generator set to 0, 1/4, 1/2, 3/4, and full rated loads. Add and remove specified loads. Record kW, Hz, and voltage. Measure voltage and frequency 10 seconds after load change. See Figure 3. Note any audible or measurable frequency variations.

Note: At the discretion of the FAA regional representative, transient performance verification testing using monitoring equipment, such as a Fluke 105B or equivalent, provided by the FAA region can be performed. Testing verifies transient performance characteristics for frequency and voltage fluctuation when applying full rated load and when removing full rated load. If performance is not within specifications, the Kohler representative will adjust engine transient response controls to meet specifications.

After completing the above, allow the generator set to run unloaded for 5 minutes prior to shutdown.

	Voltage Connection	Voltage	Hz
No Load	L3-L1		
	L1-L2		
	L2-L3		
1/4 Load _____kW	L3-L1		
	L1-L2		
	L2-L3		
1/2 Load _____kW	L3-L1		
	L1-L2		
	L2-L3		
3/4 Load _____kW	L3-L1		
	L1-L2		
	L2-L3		
Full Rated kW _____kW	L3-L1		
	L1-L2		
	L2-L3		

Figure 3 Voltage and Frequency Results

1.12 Load Bank Operations Test

- Demonstrate the manual load bank control and operation
- Demonstrate auto disconnect of the load bank using the ATS LB control relay (bypass switch in *Normal*, transfer switch in *Test*)
- Demonstrate automatic load share during the site load test (see Section 1.13)

1.13 Site Load Test and Load Bank Shed/Share Verification (Diesel Generator Sets Only)

Use this section to test the complete generator set as it would operate in an actual utility outage. Because normal power will be interrupted, coordinate and have operations approve the test time so as not to interfere with critical flight operations.

Note: If it is determined that the optional cold start test is to be performed, conduct it at this time provided the generator set has had sufficient time to cool down.

Note: The generator set should have all auxiliary systems in working order, i.e., battery and charger, block heater, day tank, etc.

Perform a two-hour site load test. Use building load and automatic mode of the load bank shed/share feature to add supplementary load. Cycle optional site load, such as air conditioning, if possible.

Note: The load bank automatic load share feature senses only one alternator phase leg. The designed balanced site loading, therefore, is critical for the correct operation of the load bank shed/share feature.

1.13.1 Switch Positions

Engine Generator	Auto
Automatic Transfer Switch	Auto
Load Bank	
Control Power	Auto
Master Load	Off
Individual Load Steps	Off

1.13.2 Load Test Procedure

1. Start generator set in the *Auto* mode by simulating a power failure. Typically, open the utility line circuit breaker to simulate a power failure.

Note: Because normal power will be interrupted, coordinate and have operations approve the test time so as not to interfere with critical flight operations.

2. Record the following as the generator set is started and full rated load applied:

- Number of seconds elapsed between start of engine cranking and engine starting: _____ seconds
- Number of seconds elapsed between engine's starting and reaching rated speed (rated Hz observed on controller display): _____ seconds

- The total number of seconds for the voltage and frequency to achieve steady state after load application: _____ seconds
- The *total time* elapsed for the test beginning when the simulated power failure started: _____ minute:second
- Fill in the Load Bank Shed/Share Record. See Figure 4.

Note: Total generator set loading should be 60%–90% of the FAA rated load.

3. Perform the generator set load test. Check and record the following at the listed intervals after startup. Use **Figure 5 for three-phase** generator sets or **Figure 6 for single-phase** generator sets.

Site Load	kW	amps
Load Bank	kW	amps
Total EG Load	kW	amps

Figure 4 Load Bank Shed/Share Record

Three-Phase Generator Set Load Test							
Interval, min.	Volts	Amps	Frequency, Hz	Oil Pressure, kPa (psi)	Water Temperature, °C (°F)	Battery Charging Rate, Volts/Amps	Day Tank Level
15		L3-L1	L3				
		L1-L2	L1				
		L2-L3	L2				
30		L3-L1	L3				
		L1-L2	L1				
		L2-L3	L2				
45		L3-L1	L3				
		L1-L2	L1				
		L2-L3	L2				
60		L3-L1	L3				
		L1-L2	L1				
		L2-L3	L2				
75		L3-L1	L3				
		L1-L2	L1				
		L2-L3	L2				
90		L3-L1	L3				
		L1-L2	L1				
		L2-L3	L2				
105		L3-L1	L3				
		L1-L2	L1				
		L2-L3	L2				
120		L3-L1	L3				
		L1-L2	L1				
		L2-L3	L2				

Figure 5 Three-Phase Generator Set Load Test Results

Single-Phase Generator Set Load Test							
Interval, min.	Volts	Amps	Frequency, Hz	Oil Pressure, kPa (psi)	Water Temperature, °C (°F)	Battery Charging Rate, Volts/Amps	Day Tank Level
15		L1-L2	L1				
		L1-L0	L2				
		L2-L0					
30		L1-L2	L1				
		L1-L0	L2				
		L2-L0					
45		L1-L2	L1				
		L1-L0	L2				
		L2-L0					
60		L1-L2	L1				
		L1-L0	L2				
		L2-L0					
75		L1-L2	L1				
		L1-L0	L2				
		L2-L0					
90		L1-L2	L1				
		L1-L0	L2				
		L2-L0					
105		L1-L2	L1				
		L1-L0	L2				
		L2-L0					
120		L1-L2	L1				
		L1-L0	L2				
		L2-L0					

Figure 6 Single-Phase Generator Set Load Test Results

4. Restore normal power by closing all switches or circuit breakers opened in earlier step.
 5. Record the time elapsed between normal power restorations and retransfer to normal power for the transfer switch (15 minutes minimum).
_____ minutes
 6. Record the time elapsed between normal power restorations and generator set shutdown:
_____ minutes
- The generator set control is fixed at 5 minutes.

1.14 Transfer/Bypass Switch

1.14.1 Visual and Mechanical Inspection

Note: Perform visual and mechanical inspections prior to energizing either source of power.

1. Inspect for physical damage, proper anchorage, and chassis grounding.
2. Verify that all power and control wiring are tight and properly terminated. Check the connections using the wiring diagram supplied with the transfer switch.
3. Verify that the transfer switch is clean and properly lubricated.
4. Manually operate the transfer switch to verify main contact alignment, gap, and wiping action.
5. Verify the proper make and break of the ATS contacts.
6. Verify the proper make and break of the auxiliary control contacts.

Comments: _____

1.14.2 ATS Contactor Removal

Demonstrate the ATS contactor removal procedure.

1.14.3 Transfer Switch Setup Verification

Note: Use FAA Order 6980.11 to determine ATS settings (copy of FAA Order 6980.11 is available from FAA at the generator site).

Kohler M340. Using the display panel set the control panel parameters per onsite requirements.

Kohler Closed-Transition with MX250 Control. Scroll through the MX250 screens and set the control panel parameters per onsite requirements.

1. Normal voltage pickup _____%
2. Emergency voltage pickup _____%
3. Normal voltage drop out _____%
4. Emergency frequency pickup _____%

5. Override momentary outages time delay (time delay engine start) _____minute:second

6. Transfer to emergency time delay (time delay normal to emergency) _____minute:second

7. Generator set cooldown (time delay engine cooldown)

Transfer Switch _____

Engine Control _____

8. Retransfer to normal time delay (Time Delay Emergency to Normal) _____minute:second

9. Verify that all customer connections are completed.

1.14.4 Electrical Test

1. Measure and compare the actual voltage to the nameplate rating.

Normal Voltage	Pass	Fail
----------------	------	------

Emergency Voltage	Pass	Fail
-------------------	------	------

2. Measure and compare the phase rotation of both power sources (must be ABC).

Normal	Pass	Fail
--------	------	------

Emergency	Pass	Fail
-----------	------	------

3. Demonstrate ATS bypass functions per the door-mounted instruction decal.

4. Verify the operation of the transfer switch to both sources.

Normal	Pass	Fail
--------	------	------

Emergency	Pass	Fail
-----------	------	------

5. Verify the operation of bypass and isolation to both sources.

Normal	Pass	Fail
--------	------	------

Emergency	Pass	Fail
-----------	------	------

6. Verify the operation of the auto start circuit.

Pass	Fail
------	------

7. Verify the immediate return to normal via the emergency source failure.

Pass	Fail
------	------

1.15 Model KBL Closed-Transition Bypass/Isolation Switch Test Procedure (if applicable)

This test is for sites equipped with closed-transition automatic transfer switches.

1. Check and adjust the generator set frequency to within 0.2 Hz of the normal source frequency.

Note: The frequency must not be exactly 60 Hz on the generator set.

2. Check and adjust the generator set voltage to within 5% of the normal source voltage (208 volts \pm 10.4 volts; 240 volts \pm 12 volts; 480 volts \pm 24 volts).
3. Obtain two AC analog voltage meters with scales of at least 1000 volts. Attach one meter from phase A commercial to phase A generator set; connect the second meter from phase B commercial to phase B generator set.
4. Station an observer to watch the facility equipment to evaluate equipment parameters, determining that the transition from commercial to the generator set and return does not induce equipment abnormalities into the operational system.
5. Station an observer to watch operation of the meters. Initiate a closed-transition transfer from commercial to the generator set and return. Observe if the meters move in synchronism and that transfer with the two sources occurs less than 10 electrical degrees and approaching synchronism (i.e., the transfer will take place at less than 3.5 volts @ 208 volts and 240 volts connections; 7 volts @ 480 volts connection, with the meters approaching zero volts).

The time required for this transfer depends on the voltage and frequency differential and phase relationship. If the time exceeds the adjustable factory setting (1 minute), the *Failure to Synchronize* alarm activates. If the generator set frequency and the normal source frequency are too close together, the time required for the two sources to synchronize will extend.

6. Increase the frequency difference but do not exceed 0.2 Hz maximum. Observe the mechanical sequence of the paralleling contactors and the transfer switch. At the time of transfer, the paralleling contacts close followed by the immediate opening of the opposite source contacts. If both sets of contacts stay closed beyond the preset time (100 msec.), the last set of contacts that closed opens and the Normal (Emergency) Failed to Open alarm and light activate. When a total time of 250 msec. elapses and both sets of contacts remain closed, an Emergency Shunt Trip alarm and light activate and a trip signal is sent to open the Generator/Emergency Source circuit breaker.

7. Repeat this test several times to ensure accuracy of observations. Record any discrepancies.

Record Test Results: Pass Fail

1.16 Day Tank Test Procedure (If Applicable)

This test is for sites equipped with a day tank.

1. Using the test button on the day tank control panel, verify indicating lamps and pump operation.
2. Record day tank levels during the two-hour test.
3. Observe that the day tank fuel pump fills the day tank as fuel is used.
4. Verify that the day tank fuel pump motor is operating on emergency power.
5. Verify that the day tank monitoring and alarm functions are working:
 - Fuel Level Indicators
 - Fuel in Basin/Leak Alarm

Note: The above indicators are enunciated on the pump control panel, and the low fuel level is also shown on the generator set controller panel.

Record Test Results: Pass Fail

1.17 Remote Monitoring System

The Remote Monitoring System (RMS) for Kohler ATS monitors the following data:

- Normal source voltage
- Emergency source voltage
- Transfer switch position (Normal or Emergency)
- Low oil pressure alarm
- High water temperature alarm

Note: The local FAA operating personnel must be trained on its use and the monitoring PC requires set up before verification of the remote monitoring system can be completed. This will be done by FAA personnel.

Refer to the *FAA Summary of Remote Monitoring System* for remote monitoring system installation and operation.

1.18 Onsite Technician Maintenance Training

Note: After completing startup, Kohler recommends that the FAA technician run the generator set for an additional 4 hours (load bank only, no site load) varying the load between 60% and 100%, changing load hourly to properly break in the new engine. Refer to the engine manufacturer's operation manual for additional information. Because the engine is new, the initial oil change interval may be shorter than normal.

Completed	Training
	Safety Precautions and Instructions, Auto-Start
	Safety Precautions and Instructions, Owner's Manual Issues
	Review parts identification procedures; see Section 2
	Review operation manual maintenance schedule and procedures
	Review the functions and maintenance needed on the following system components:
	Engine Description
	Engine Maintenance
	Generator Overview
	Generator Safeguard Breaker
	Generator Maintenance
	Generator Main Breaker
	Controller Lamps
	Controller Digital Display
	Controller Switches
	Controller Fuses
	Controller E-stop Features
	Controller Shutdowns/Prealarm
	Dry Contact Board
	Battery Maintenance
	Battery Charger Features
	Battery Charger Maintenance, Electrolyte Level
	Battery Charger Maintenance, Specific Gravity
	Automatic Transfer Switch
	Load Bank Operation Manual
	Load Bank Operation Automatic Shed/Share (diesel generator sets only)
	Day Tank Operation (diesel generator sets only)
	Day Tank System Test (diesel generator sets only)
	Fuel Converter (gas generator sets only)
	LP Gas Leak Alarm (gas generator sets only)

Section 2 Parts Identification

Information in this publication represents data available at the time of print. Kohler Co. reserves the right to change this publication and the products represented without notice and without any obligation or liability whatsoever.

2.1 Numbering System Significance

This document uses the following numbering systems:

Specification Number. The product identification number located on the generator set nameplate. Specification numbers break down into groups.

Group Number. A unique number representing a parts group needed to assemble a generator set function. For example, Group 101 is the Air Intake group.

Variation or Module Number. A group might have several variations. Each variation performs the same function with different parts lists. For example, a 50 Hz generator alternator and a 60 Hz generator alternator both perform the same function; however, with different parts. Each difference requires a group variation or module number.

Part Number. The part number identifies an individual assembly, subassembly, component, or accessory kit.

2.2 How to Find Part Numbers

Use FAA Service Parts Location Guide Bulletins (FB-xx) to help find Kohler replacement part numbers.

2.3 Hardware References

Many common hardware items do not appear in parts manuals or will appear as common hardware entries. A common hardware entry lists the size of the hardware. For example, an item that appears as *Hardware, 3/8-16* in the text means that the piece is 3/8-16 size. Obtain common hardware locally or, if contacting the factory, use the Common Hardware List in Section 4 to identify the common hardware part number and specifications. See Section 3, Common Hardware Application Guidelines, for mating hardware instructions.

Some hardware items require a specific size or some other characteristic. In that case, use the part number listed in the text.

When replacing hardware, do not substitute inferior grade hardware. Replacement hardware grade should be equal to or better than the grade of the manufacturer's original hardware. Use the Common Hardware List in Section 4 to identify the common hardware hardness.

Section 3 Common Hardware Application Guidelines

Use the information below and on the following pages to identify proper fastening techniques when no specific reference for reassembly is made.

Bolt/Screw Length: When bolt/screw length is not given, use Figure 1 as a guide. As a general rule, a minimum length of one thread beyond the nut and a maximum length of 1/2 the bolt/screw diameter beyond the nut is the preferred method.

Washers and Nuts: Use split lock washers as a bolt locking device where specified. Use SAE flat washers with whiz nuts, spirallock nuts, or standard nuts and preloading (torque) of the bolt in all other applications.

Steps for common hardware application:

1. Determine entry hole type: round or slotted.
2. Determine exit hole type: fixed female thread (weld nut), round, or slotted.

For round and slotted exit holes, determine if hardware is greater than 1/2 inch in diameter, or 1/2 inch in diameter or less. Hardware that is *greater than 1/2 inch* in diameter takes a standard nut and SAE washer. Hardware *1/2 inch or less* in diameter can take a properly torqued whiz nut or spirallock nut. See Figure 2.

3. Follow these SAE washer rules after determining exit hole type:
 - a. Always use a washer between hardware and a slot.
 - b. Always use a washer under a nut (see 2 above for exception).
 - c. Use a washer under a bolt when the female thread is fixed (weld nut).
4. Refer to Figure 2, which depicts the preceding hardware configuration possibilities.

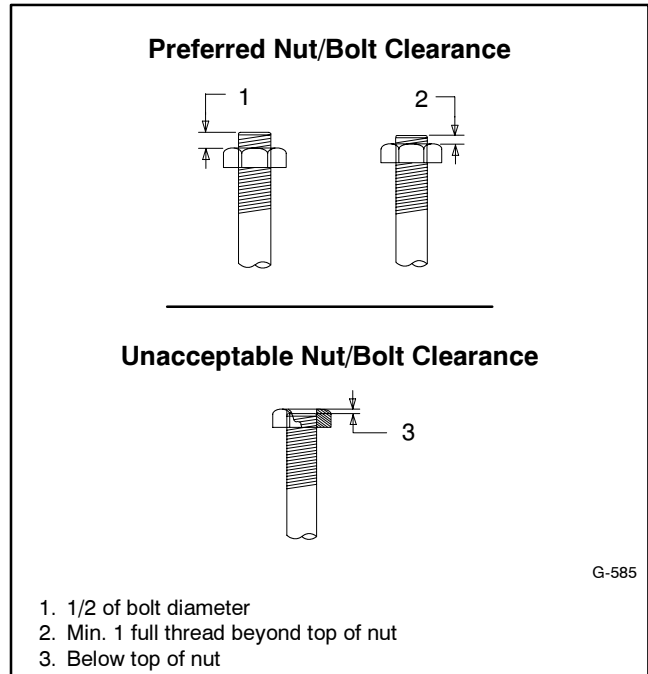


Figure 1 Acceptable Bolt Lengths

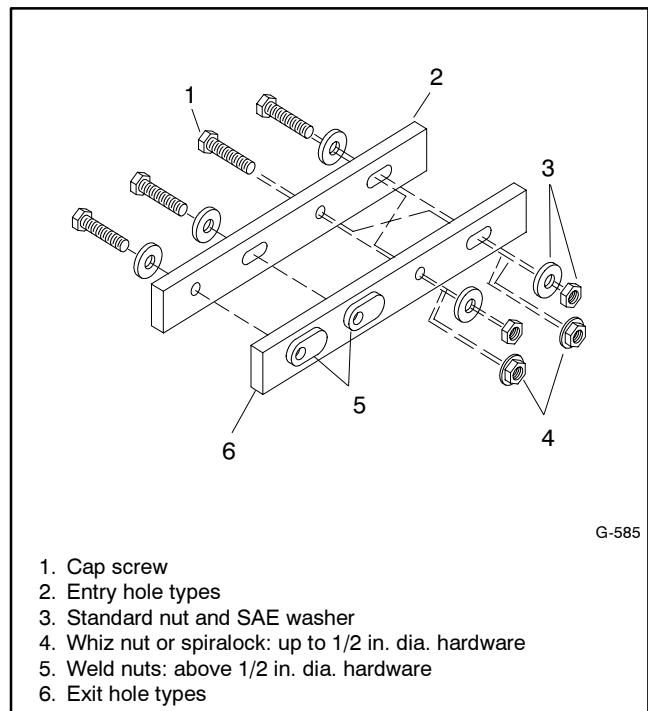


Figure 2 Acceptable Hardware Combinations

Section 4 Common Hardware List

The Common Hardware List lists part numbers and dimensions for common hardware items.

American Standard

Part No.	Dimensions	Part No.	Dimensions	Part No.	Dimensions	Type
Hex Head Bolts (Grade 5)		Hex Head Bolts, cont.		Hex Nuts		
X-465-17	1/4-20 x .38	X-6024-5	7/16-14 x .75	X-6009-1	1-8	Standard
X-465-6	1/4-20 x .50	X-6024-2	7/16-14 x 1.00	X-6210-3	6-32	Whiz
X-465-2	1/4-20 x .62	X-6024-8	7/16-14 x 1.25	X-6210-4	8-32	Whiz
X-465-16	1/4-20 x .75	X-6024-3	7/16-14 x 1.50	X-6210-5	10-24	Whiz
X-465-18	1/4-20 x .88	X-6024-4	7/16-14 x 2.00	X-6210-1	10-32	Whiz
X-465-7	1/4-20 x 1.00	X-6024-11	7/16-14 x 2.75	X-6210-2	1/4-20	Spiralock
X-465-8	1/4-20 x 1.25	X-6024-12	7/16-14 x 6.50	X-6210-6	1/4-28	Spiralock
X-465-9	1/4-20 x 1.50	X-129-15	1/2-13 x .75	X-6210-7	5/16-18	Spiralock
X-465-10	1/4-20 x 1.75	X-129-17	1/2-13 x 1.00	X-6210-8	5/16-24	Spiralock
X-465-11	1/4-20 x 2.00	X-129-18	1/2-13 x 1.25	X-6210-9	3/8-16	Spiralock
X-465-12	1/4-20 x 2.25	X-129-19	1/2-13 x 1.50	X-6210-10	3/8-24	Spiralock
X-465-14	1/4-20 x 2.75	X-129-20	1/2-13 x 1.75	X-6210-11	7/16-14	Spiralock
X-465-21	1/4-20 x 5.00	X-129-21	1/2-13 x 2.00	X-6210-12	1/2-13	Spiralock
X-465-25	1/4-28 x .38	X-129-22	1/2-13 x 2.25	X-6210-15	7/16-20	Spiralock
X-465-20	1/4-28 x 1.00	X-129-23	1/2-13 x 2.50	X-6210-14	1/2-20	Spiralock
X-125-33	5/16-18 x .50	X-129-24	1/2-13 x 2.75	X-85-3	5/8-11	Standard
X-125-23	5/16-18 x .62	X-129-25	1/2-13 x 3.00	X-88-12	3/4-10	Standard
X-125-3	5/16-18 x .75	X-129-27	1/2-13 x 3.50	X-89-2	1/2-20	Standard
X-125-31	5/16-18 x .88	X-129-29	1/2-13 x 4.00	Washers		
X-125-5	5/16-18 x 1.00	X-129-30	1/2-13 x 4.50	Part No.	ID	OD
X-125-24	5/16-18 x 1.25	X-463-9	1/2-13 x 5.50			Thick.
X-125-34	5/16-18 x 1.50	X-129-44	1/2-13 x 6.00			Bolt/ Screw
X-125-25	5/16-18 x 1.75	X-129-51	1/2-20 x .75	X-25-46	.125	.250
X-125-26	5/16-18 x 2.00	X-129-45	1/2-20 x 1.25	X-25-9	.156	.375
230578	5/16-18 x 2.25	X-129-52	1/2-20 x 1.50	X-25-48	.188	.438
X-125-29	5/16-18 x 2.50	X-6021-3	5/8-11 x 1.00	X-25-36	.219	.500
X-125-27	5/16-18 x 2.75	X-6021-4	5/8-11 x 1.25	X-25-40	.281	.625
X-125-28	5/16-18 x 3.00	X-6021-2	5/8-11 x 1.50	X-25-85	.344	.687
X-125-22	5/16-18 x 4.50	X-6021-1	5/8-11 x 1.75	X-25-37	.406	.812
X-125-32	5/16-18 x 5.00	273049	5/8-11 x 2.00	X-25-34	.469	.922
X-125-35	5/16-18 x 5.50	X-6021-5	5/8-11 x 2.25	X-25-26	.531	1.062
X-125-36	5/16-18 x 6.00	X-6021-6	5/8-11 x 2.50	X-25-15	.656	1.312
X-125-40	5/16-18 x 6.50	X-6021-7	5/8-11 x 2.75	X-25-29	.812	1.469
X-125-43	5/16-24 x 1.75	X-6021-12	5/8-11 x 3.75	X-25-127	1.062	2.000
X-125-44	5/16-24 x 2.50	X-6021-11	5/8-11 x 4.50			
X-125-30	5/16-24 x .75	X-6021-10	5/8-11 x 6.00			
X-125-39	5/16-24 x 2.00	X-6021-9	5/8-18 x 2.50			
X-125-38	5/16-24 x 2.75	X-6239-1	3/4-10 x 1.00			
X-6238-2	3/8-16 x .62	X-6239-8	3/4-10 x 1.25			
X-6238-10	3/8-16 x .75	X-6239-2	3/4-10 x 1.50			
X-6238-3	3/8-16 x .88	X-6239-3	3/4-10 x 2.00			
X-6238-11	3/8-16 x 1.00	X-6239-4	3/4-10 x 2.50			
X-6238-4	3/8-16 x 1.25	X-6239-5	3/4-10 x 3.00			
X-6238-5	3/8-16 x 1.50	X-6239-6	3/4-10 x 3.50			
X-6238-1	3/8-16 x 1.75	X-792-1	1-8 x 2.25			
X-6238-6	3/8-16 x 2.00	X-792-5	1-8 x 3.00			
X-6238-17	3/8-16 x 2.25	X-792-8	1-8 x 5.00			
X-6238-7	3/8-16 x 2.50					
X-6238-8	3/8-16 x 2.75					
X-6238-9	3/8-16 x 3.00					
X-6238-19	3/8-16 x 3.25					
X-6238-12	3/8-16 x 3.50					
X-6238-20	3/8-16 x 3.75					
X-6238-13	3/8-16 x 4.50					
X-6238-18	3/8-16 x 5.50					
X-6238-25	3/8-16 x 6.50					
X-6238-14	3/8-24 x .75					
X-6238-16	3/8-24 x 1.25					
X-6238-21	3/8-24 x 4.00					
X-6238-22	3/8-24 x 4.50					

Metric

Hex head bolts are hardness grade 8.8 unless noted.













Part No.	Dimensions	Part No.	Dimensions	Part No.	Dimensions	Type
Hex Head Bolts (partial thread)		Hex Head Bolts (full thread)		Hex Nuts		
M931-05055-60	M5-0.80 x 55	M933-04006-60	M4-0.70 x 6	M934-03-50	M3-0.50	Standard
M931-06040-60	M6-1.00 x 40	M933-05035-60	M5-0.80 x 35	M934-035-50	M3.5-0.50	Standard
M931-06055-60	M6-1.00 x 55	M933-05050-60	M5-0.80 x 50	M934-04-50	M4-0.70	Standard
M931-06060-60	M6-1.00 x 60	M933-06010-60	M6-1.00 x 10	M934-05-50	M5-0.80	Standard
M931-06070-60	M6-1.00 x 70	M933-06014-60	M6-1.00 x 14	M982-05-80	M5-0.80	Elastic Stop
M931-06070-SS	M6-1.00 x 70	M933-06016-60	M6-1.00 x 16	M934-06-60	M6-1.00	Standard
M931-06075-60	M6-1.00 x 75	M933-06020-60	M6-1.00 x 20	M934-06-64	M6-1.00	Std. (green)
M931-06090-60	M6-1.00 x 90	M933-06025-60	M6-1.00 x 25	M6923-06-80	M6-1.00	Spirallock
M931-06150-60	M6-1.00 x 150	M933-06040-60	M6-1.00 x 40	M982-06-80	M6-1.00	Elastic Stop
M931-08035-60	M8-1.25 x 35	M933-06050-60	M6-1.00 x 50	M934-08-60	M8-1.25	Standard
M931-08040-60	M8-1.25 x 40	M933-08012-60	M8-1.25 x 12	M6923-08-80	M8-1.25	Spirallock
M931-08040-82	M8-1.25 x 40*	M933-08016-60	M8-1.25 x 16	M982-08-80	M8-1.25	Elastic Stop
M931-08045-60	M8-1.25 x 45	M933-08020-60	M8-1.25 x 20	M934-10-60	M10-1.50	Standard
M931-08050-60	M8-1.25 x 50	M933-08025-60	M8-1.25 x 25	M934-10-60F	M10-1.25	Standard
M931-08055-60	M8-1.25 x 55	M933-08030-60	M8-1.25 x 30	M6923-10-80	M10-1.50	Spirallock
M931-08055-82	M8-1.25 x 55*	M933-08030-82	M8-1.25 x 30*	M6923-10-62	M10-1.50	Spirallock†
M931-08060-60	M8-1.25 x 60	M933-10012-60	M10-1.50 x 12	M982-10-80	M10-1.50	Elastic Stop
M931-08070-60	M8-1.25 x 70	M961-10020-60	M10-1.25 x 20	M934-12-60	M12-1.75	Standard
M931-08070-82	M8-1.25 x 70*	M933-10020-60	M10-1.50 x 20	M934-12-60F	M12-1.25	Standard
M931-08075-60	M8-1.25 x 75	M933-10025-60	M10-1.50 x 25	M6923-12-80	M12-1.75	Spirallock
M931-08080-60	M8-1.25 x 80	M961-10030-60	M10-1.25 x 30	M982-12-80	M12-1.75	Elastic Stop
M931-08090-60	M8-1.25 x 90	M933-10030-60	M10-1.50 x 30	M982-14-80	M14-2.00	Elastic Stop
M931-08095-60	M8-1.25 x 95	M933-10030-82	M10-1.50 x 30*	M6923-16-80	M16-2.00	Spirallock
M931-08100-60	M8-1.25 x 100	M961-10035-60	M10-1.25 x 35	M982-16-80	M16-2.00	Elastic Stop
M931-08120-60	M8-1.25 x 120	M933-10035-60	M10-1.50 x 35	M934-18-80	M18-2.5	Standard
M931-08130-60	M8-1.25 x 130	M933-12016-60	M12-1.75 x 16	M982-18-80	M18-2.50	Elastic Stop
M931-08140-60	M8-1.25 x 140	M933-12020-60	M12-1.75 x 20	M934-20-80	M20-2.50	Standard
M931-10040-82	M10-1.25 x 40*	M933-12025-60	M12-1.75 x 25	M982-20-80	M20-2.50	Elastic Stop
M931-10040-60	M10-1.50 x 40	M933-12025-82	M12-1.75 x 25*	M934-22-60	M22-2.50	Standard
M931-10045-60	M10-1.50 x 45	M961-12030-60	M12-1.25 x 30	M934-24-80	M24-3.00	Standard
M931-10050-60	M10-1.50 x 50	M933-12030-60	M12-1.75 x 30	M982-24-80	M24-3.00	Elastic Stop
M931-10055-60	M10-1.50 x 55	M933-12035-60	M12-1.75 x 35	M934-30-80	M30-3.50	Standard
M931-10060-60	M10-1.50 x 60	M961-12040-82	M12-1.25 x 40*			
M931-10065-60	M10-1.50 x 65	M933-12040-60	M12-1.75 x 40			
M931-10070-60	M10-1.50 x 70	M933-12040-82	M12-1.75 x 40*			
M931-10080-60	M10-1.50 x 80	M961-14025-60	M14-1.50 x 25			
M931-10090-60	M10-1.50 x 90	M933-14025-60	M14-2.00 x 25			
M931-10090-82	M10-1.50 x 90*					
M931-10100-60	M10-1.50 x 100	M961-16025-60	M16-1.50 x 25			
M931-10110-60	M10-1.50 x 110	M933-16025-60	M16-2.00 x 25			
M931-10120-60	M10-1.50 x 120	M961-16030-82	M16-1.50 x 30*			
M931-10130-60	M10-1.50 x 130	M933-16030-82	M16-2.00 x 30*			
M931-10140-60	M10-1.50 x 140	M933-16035-60	M16-2.00 x 35			
M931-10180-60	M10-1.50 x 180	M961-16040-60	M16-1.50 x 40			
M931-12045-60	M12-1.75 x 45	M933-16040-60	M16-2.00 x 40			
M960-12050-60	M12-1.25 x 50	M933-16050-60	M16-2.00 x 50			
M960-12050-82	M12-1.25 x 50*	M933-16050-82	M16-2.00 x 50*			
M931-12050-60	M12-1.75 x 50	M933-16060-60	M16-2.00 x 60			
M931-12055-60	M12-1.75 x 55					
M931-12060-60	M12-1.75 x 60	M933-18035-60	M18-2.50 x 35			
M931-12065-60	M12-1.75 x 65	M933-18050-60	M18-2.50 x 50			
M931-12075-60	M12-1.75 x 75	M933-18060-60	M18-2.50 x 60			
M931-12080-60	M12-1.75 x 80	M933-20050-60	M20-2.50 x 50			
M931-12090-60	M12-1.75 x 90	M933-20055-60	M20-2.50 x 55			
M931-12100-60	M12-1.75 x 100					
M931-12110-60	M12-1.75 x 110					
M960-16090-60	M16-1.50 x 90					
M931-16090-60	M16-2.00 x 90					
M931-16100-60	M16-2.00 x 100					
M931-20065-60	M20-2.50 x 65					
M931-20120-60	M20-2.50 x 120					
M931-20160-60	M20-2.50 x 160					
M931-22090-60	M22-2.50 x 90					
M931-22120-60	M22-2.50 x 120					
M931-22160-60	M22-2.50 x 160					
M931-24090-60	M24-3.00 x 90					
M931-24120-60	M24-3.00 x 120					
M931-24160-60	M24-3.00 x 160					
				</		

Appendix A Menu 14, Programming Mode

Key Entry	Display	Description
RESET MENU	ENTER MENU NO. 1-15	Input menu number 14.
1 4	MAIN MENU NUMBER 14	Press the Enter key.
ENTER ←	MENU 14 PROGRAMMING MODE	Displays the menu number and name.
MENU ↓	PROGRAMMING MODE → (USER DEFINED) Y/N	Displays the user-defined programming mode. Press the Down arrow key if local programming mode is displayed. If local programming mode is not displayed, press the Right arrow key until the local programming mode appears.
MENU →	PROGRAMMING MODES OFF Y/N LOCAL N/Y REMOTE N/Y	Entering YES selects the programming mode shown. Note: Selecting one programming mode deselects any previously selected choice.
7 YES	PROGRAMMING MODE → LOCAL YES	Press the Enter key.
ENTER ←	PROGRAMMING MODE ENTER CODE *	Changing the programming mode requires entering the access code. Enter the access code. Note: The factory default access code is the number 0.
0 LAMP TEST	PROGRAMMING MODE ENTER CODE *	Press the Enter key.
ENTER ←	PROGRAMMING MODE → LOCAL YES	Confirms the entry.















The controller programming mode yellow LED is now flashing indicating the local programming mode. Proceed to Menu 10, Output Setup shown in Appendix B.

Appendix B Menu 10, Output Setup

Key Entry	Display	Description
	ENTER MENU NO. 1-15	Input menu number 10.
 	MAIN MENU NUMBER 10	Press the Enter key.
	MENU 10 OUTPUT SETUP	Displays the menu number and name.
	DEFINE COMMON FAULTS →	Displays the common faults heading.
	RELAY DRV OUT 01 Y/N OVERSPEED	Displays the relay driver out 01 selection. Continue to press the Menu Down key until relay driver out 30 appears.
	RELAY DRV OUT 30 Y/N LOAD SHED KW OVER	Displays the relay driver out 30 selection. If relay driver out 30 indicates load shed kW over the setup is correct. Proceed to Menu 7, Generator System, shown in Appendix C.
		----- If relay driver out 30 does not indicate load shed kW over, continue to the next step. -----
	SYSTEM EVENTS →	Displays the system events heading. Press the Menu Down key.
	RELAY DRV OUT 30 Y/N EMERGENCY STOP	Displays the emergency stop selection. Continue to press (31 times) the Menu Down key until Load Shed kW Over appears.
	RELAY DRV OUT 30 NO LOAD SHED KW OVER	Displays the emergency stop selection. Press the Yes key.
	RELAY DRV OUT 30 YES LOAD SHED KW OVER	Press the Enter key.
	RELAY DRV OUT 30 YES LOAD SHED KW OVER	Confirms the entry.


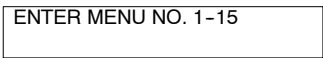

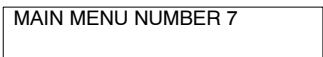

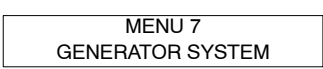

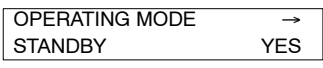








Proceed to Menu 7, Generator System, shown in Appendix C.

Appendix C Menu 7, Generator System

Key Entry	Display	Description
	ENTER MENU NO. 1-15	Input menu number 7.
	MAIN MENU NUMBER 7	Press the Enter key.
	MENU 7 GENERATOR SYSTEM	Displays the menu number and name.
	OPERATING MODE → (see note) YES	Displays the operating mode selection. Note: The display sample may differ depending upon previous entries. The previously selected operating mode appears first, either standby or prime power. Enable the standby operating mode if prime power appears.
<hr/>		
	OPERATING MODE → PRIME POWER YES	If the prime power operating mode selection appears, press the Menu Right key.
	OPERATING MODE → STANDBY NO	Press the Yes key.
	OPERATING MODE → STANDBY YES	Press the Enter key.
	OPERATING MODE → STANDBY YES	Confirms the entry.
<hr/>		
	OPERATING MODE → STANDBY YES	Continue to press (6 times) the Menu Down key until Load Shed Output appears.
	LOAD SHED OUTPUT → 100% # KW	Use the numeric keys to change value to 80.
 	LOAD SHED OUTPUT → 80% # KW	Press the Enter key.
	LOAD SHED OUTPUT → 80% # KW	Confirms the entry.
	TIME DELAY MIN:SEC → ??:??	Displays the load shed time (minutes:seconds) delay setting. Use the numeric keys to set the value to 5 seconds.
	TIME DELAY MIN:SEC → 00:05	Press the Enter key.
	TIME DELAY MIN:SEC → 00:05	Confirms the entry.











The load shed output values established in this Menu are intended for test purposes. Instructions will be given later in this procedure to change the value back to 100%. Proceed to step 1.10.3, Start Generator Set and Load Bank.

Appendix D Menu 7, Generator System

Key Entry	Display	Description
		Input menu number 7.
		Press the Enter key.
		Displays the menu number and name.
		Displays the standby operating mode selection. Continue to press (6 times) the Menu Down key until Load Shed Output appears.
		Use the numeric keys to change value to 100.
  		Press the Enter key.
		Confirms the entry.

Proceed to Menu 14, Programming Mode, shown in Appendix E.

Appendix E Menu 14, Programming Mode

Key Entry	Display	Description
	ENTER MENU NO. 1-15	Input menu number 14.
 	MAIN MENU NUMBER 14	Press the Enter key.
	MENU 14 PROGRAMMING MODE	Displays the menu number and name.
	PROGRAMMING MODE → LOCAL YES	Displays the local programming mode. Press the Right arrow key until the programming mode OFF appears.
	PROGRAMMING MODES OFF Y/N LOCAL N/Y REMOTE N/Y	Entering YES selects the programming mode shown. Note: Selecting one programming mode deselects any previously selected choice.
<hr/>		
	PROGRAMMING MODE → OFF YES	Press the Enter key.
	PROGRAMMING MODE ENTER CODE *	Changing the programming mode requires entering the access code. Enter the access code. Note: The factory default access code is the number 0.
	PROGRAMMING MODE ENTER CODE *	Press the Enter key.
	PROGRAMMING MODE → OFF YES	Confirms the entry.

The controller programming mode yellow LED is now OFF indicating the programming mode is OFF. Proceed to 1.10.5, Restore the Site to Normal Conditions, step 7.

Notes

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